

Appendix B: Back-Propagation Algorithm – Crisp Neural Network

A multilayered feed-forward crisp neural network consists of three layers of neurons, viz. the input, the hidden, and the output. Back-propagation algorithm used for training the neural network follows the procedure of repetitively presenting a set of input patterns and corresponding target patterns; and iteratively adjusting the values of the connection weights so as to minimize the average squared output deviation error function over all training patterns.

The simplest multilayered feed-forward neural network consists of three layers of neurons, viz. the input, the hidden, and the output with n_i , n_h and n_o neurons, respectively. The input pattern, which is a vector of real elements of dimension n_i , is fanned out by the input neurons, processed, and forwarded to the output layer through the hidden layer weighted by the connection strengths from all the nodes (sending neurons) of the preceding layer. Processing nodes in the hidden or output layers collect the sum of the output values from the preceding layer, activate it through a sigmoidal function, and forward the resultant outputs to all the connections towards the nodes of the successive layers. The number of neurons in the input and output layers are determined by the system description. There are no generic rules for the choice of the number of neurons in the hidden layers. The values of the connection weights are determined in an interactive manner through a training procedure.

Appendix C: Fuzzy Partial Ordering Technique

When a fuzzy partial ordering is defined on a set X , then two fuzzy sets are associated with each of elements x in X . The first is called the dominating class of x . It is denoted by $R \geq_{|x|}$ and is defined by

$$m_{R \geq_{|x|}}(y) = \mu R(x, y),$$

where $y \in Y$. In other words, the dominating class of x contains the members of X to the degree to which they dominate x . The second set of fuzzy set of concern is the class dominated by x , which is denoted by

$$R \leq_{|x|}(y) = \mu R(x, y).$$

Where y is dominated, class x contains the elements of X to the degree to which they are dominated by x .

An element $x \in X$ is undominated if and only if

$$\mu R(x, y) = 0$$

for all $y \in X$ and $x \neq y$; an element x is undominating if and only if

$$\mu R(y, x) = 0$$

for all $y \in X$ and $y \neq x$.

Institutions: The LCA-Society of Italy

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The Italian Society of LCA ("Associazione Italiana di Analisi del Ciclo di Vita") was officially established in March 1999 at the Environment Park of Turin.

After about two years of meetings, and an exchange of information and ideas via e-mail, the legal form of the association and its location were finally agreed upon.

Environment Park is a Science and Technology Park dedicated to environmental technologies. Since Environment Park has the primary purpose of promoting the development of applied environmental research and facilitating the integration of environmental variables and factors into the process of production, as well as bringing the world's researchers and businesses together, the unification with the Italian Society of LCA seemed to be a good opportunity both for the site and the common objectives.

With over 50 members representing the most important industries (ABB, ENI, FIAT, ITALTEL, PIRELLI, TELECOM), universities (Bari, Bologna, Torino, Palermo), research centres (ENEA, Fiat Research Centre), environmental agencies (national and local EPAs) and consulting companies (Boustead, Ecobilan, Take Care), it is now the most important reference point for LCA activities in Italy.

The promotion of LCA development, as well as the review of proposed legislation and environmental standards with LCA im-

plications, is the primary mandate of the association. Several operative actions, such as the definition of discussion panels (e.g. on Life Cycle Impact Assessment, Life Cycle Costing, Energy systems, ...), organisation of seminars and internal working groups, are ongoing. Furthermore, according to EPA indications, the possibility to create an internal board for critically reviewing LCA public works in Italy is also being considered.

Environment Park (Turin) and ENEA (Bologna) will house two open libraries containing papers and books, while a web site will ensure up to date information about news and events. The growing presence of students working in this field in Italy now has the possibility of looking for information in a few places and of receiving assistance from LCA practitioners via e-mail.

Some members are present on international boards such as SETAC's Steering Committee and the ISO working groups for the 14.040 series.

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